

Washington State University Combined Research and Extension Plan of Work 2020-2024

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I. Plan Overview

1. Executive Summary

The primary goals of the Washington State University (WSU) Agricultural Research Center (ARC - the Agricultural Experiment Station of the State of Washington) and of Washington State University Extension are to conduct research beneficial to the citizens of Washington State and to extend relevant research results generated here and elsewhere, as well as research-informed programmatic engagement, to stakeholders within the state and beyond. We strive to create outcomes that improve the economic viability, environmental sustainability, community resilience, and quality of life for our people. We recognize that we have unique land grant research and outreach missions to serve the people of Washington to enhance their quality of life and to evaluate both short and long-term consequences of potential policies, decisions and actions. The ARC provides leadership in discovering and accessing knowledge by carrying out high quality research that contributes to a safe and abundant food supply; promotes the well-being of individuals, families, and communities; encourages sustainability of agricultural and economic systems; promotes energy innovation; and encourages careful stewardship of natural resources and ecological systems. WSU Extension creates programs with measurable deliverables and outcomes that leverage the research base of the University and the world to address primary and timely issues in ways that lead to economic development, improved policy and governance, sustainability and resilience as well as personal, family, and environmental wellbeing. The synergy provided by integrating research capacity, problem-solving skills and the statewide engagement of ARC and Extension provides unique capacity to address pressing issues and problems while recognizing different perspectives. This maximizes the delivery of valuable contributions to our residents and society.

The WSU ARC and WSU Extension have many natural and structural links. All Washington State University faculty members have responsibilities that include both research and outreach, with many having formal joint appointments. This is particularly true within the College of Agricultural, Human and Natural Resource Sciences (CAHNRS), which houses both ARC and Extension. More than 100 faculty in ARC or Academic positions hold partial Extension appointments. An additional 100 or more faculty have full Extension appointments with a primary focus on off-campus program delivery, applied outreach and direct engagement. The focus of our joint efforts is to provide for the primary needs of the people of Washington State. As part of this core mission, the ARC has made significant commitments to focus on fourteen high priority research areas that advance our land-grant mission in discovery and development research. These research areas are (1) precision and automated agricultural systems, (2) soil-plant interactions: chemical, physical, and biological processes, (3) sustainable food production from livestock, (4) developing food processing, safety, quality, and supply solutions for production of high quality and safe food, (5) promoting health and wellness of individuals, families, and communities, (6) reducing the impact of pests and diseases affecting Washington agriculture, (7) crop improvement and sustainable production systems, (8) enhancing sustainability across diverse agricultural systems, (9) natural resources, (10) integrated research and societal engagement to address global water challenges, (11) functional genomics in animal improvement, food safety, and human health, (12) integrated crop and weed management systems, (13) molecular plant sciences: plant productivity in a dynamic environment, and (14) bioenergy and biofuel.

WSU Extension delivers significant outreach related to natural resource stewardship; food safety; health and wellness; youth and family development; governance, sustainability and community economic development. The efforts of ARC and Extension are not the only components of WSU that work to reach these goals, but they are a committed element of a broader set of programs that reside in the many WSU colleges and interdisciplinary centers, including CAHNRS; the Voliland College of Engineering and Architecture; the College of Arts and Sciences; the College of Pharmacy; the College of Veterinary Medicine; the new Elson Floyd College of Medicine, the Center for Environmental Research, Education and Outreach; and the three outreach centers of the Community and Economic Development program unit: the William D. Ruckelshaus Center (a joint program with the University of Washington), the Division of Governmental Studies and Services, and the Metropolitan Center for Applied Research and Extension. Additionally, through close partnerships and

collaborative agreements, our Research and Extension faculty also extend the research conducted by faculty at other regional centers of expertise, including the University of Washington, Oregon State University, and the University of Idaho.

The state of Washington is beautiful, rich in natural resources, and has a highly diverse topography and climate. This diversity is also reflected in our people, communities, industries, and our significant natural resources. Our agricultural systems are among the most diverse in the nation and the state produces nearly 300 different crops that are sold domestically or exported, largely to countries in the Pacific Rim. Washington is especially known for its apples, pears, sweet cherries, wheat, potatoes, beef, milk and milk products and wine, and it produces a major share of many specialty crops, like small fruits (e.g. grapes, berries), seeds (e.g., vegetables, alfalfa), pulse legumes, hops, and mint. Most of the state's farm and ranch lands are in Central and Eastern Washington but most of the state's population is located in a coastal zone on the west side of the Cascade Mountains in the I-5 corridor that stretches from the Canadian border south to Vancouver, Washington and the Oregon border. Western Washington is characterized by an expanding urban population, which values environmental quality and supports local food systems. Because of the dense population in an area with good agricultural conditions, including a moderate climate, rich alluvial soils, and abundant rainfall, this region of Washington is home to a small but extraordinarily diverse agriculture that focuses on high value production. Eastern Washington is characterized by larger farming operations, especially in the cultivation of wheat, potatoes, legumes, tree fruits, and wine grapes. Our forested lands are primarily in coastal regions, the Cascade Range, and in northwestern and southwestern Washington and they contribute significantly to the state's economy and overall quality of life through economic and recreational opportunities. Washington is also home to two great rivers, the Columbia and the Snake, which provide transportation, electrical power, irrigation, and important fish and wildlife habitat. Other river systems, coastal regions, and the Puget Sound support abundant yet fragile aquatic and marine ecosystems and provide a rich mosaic unique to the Pacific Northwest.

The diversity of Washington doesn't end with its physical features as the state also has continually evolving demographic dynamics, which influence the cultural and political milieu. The state has a significant Native American population with 29 Federally-recognized tribes. There is a significant Hispanic population, especially in the central and south-central counties, and a large Asian population in Western Washington. While this diversity is enriching the tapestry of the state by hosting a multitude of cultures, foods, and arts, these demographic shifts also strain social services and challenge educational delivery systems. The health and wellness of our youth are also at risk with over 26% of our adult population categorized as obese and almost 30% of our youth categorized as overweight or obese. Our rural communities are struggling with increased poverty and with differential access to technology, health services, and educational opportunities. In such a diverse cultural and environmental landscape, research, technology transfer, and outreach are challenging but essential.

The agricultural industry is a constantly shifting tableau. Weather variability and climate change have had significant impacts on water availability and facilitate migration of new plant and animal diseases and pests into the state. New varieties of crops, both domestically and internationally developed, compete for market share but also provide our growers with new opportunities; constant changes in disease and pest pressure, input costs, and per bushel prices affect how we grow our crops and what we incorporate into our crop rotations; agriculture labor supplies affect the timing and cost of our fruit harvests; and, as importantly, changes in consumer demand and governmental policy shape, and may even dictate, direction. The dynamics of our communities change as the result of changing demographics, changes in transportation, communication, educational and health care opportunities, and the availability and stability of employment locally.

As we examine how to adapt to these changes and challenges, we provide the expertise that allow us to take advantage of all potential opportunities. Examples of relatively newly created opportunities include the possibility of growing and processing industrial hemp for oil and fiber, a Washington State viticulture and enology enterprise, an economically viable and important organic agriculture industry, and the increasing importance of niche legumes in crop rotations. Washington has the second largest wine industry in the United States but there are issues related to local climate, soil, and pest management that need to be resolved to exploit the potential of this crop. The partnership that has developed between the research, Extension, and industry components of the viticulture and enology arena are truly outstanding and a model for future endeavors. Our commercial tree fruit industry has funded several endowed faculty positions that will continue to keep us at the cutting edge of research. Our organic agriculture growers and researchers are pioneers in the 5% market share that organic agriculture has in total U.S. agricultural production, and Washington State's contributions are second in the nation. We also continue to explore avenues where we have traditionally been a world leader. We have many researchers involved in breeding programs to adapt crops such as wheat and tree fruits to drought and high temperature conditions.

There are also many other challenges to Washington State that impact our citizens. Our natural resources are at risk from land conversion, wildfires, and pollution. Counties across the state experience severe and emergency drought conditions. This had severe negative impacts on all aspects of life for our citizens but was especially impactful for agriculture. Another issue that is rising to the forefront are pollutants in our environment that are serious concerns for the safety and health of our water systems. Our Washington Stormwater Center was created in 2009 by House Bill 2222 and it is a technical resource center in partnership with the University of Washington and the Washington Department of Ecology to provide tools for storm water management. We are also partners in the State of Washington Water Research Center (it is directed by our faculty) which conducts research on water, fosters education of future water professionals, and serves as a nexus for the academic community, water resource managers, and water stakeholders. Because of studies on water management for multiple uses, our economists are critically examining current and future water use for urban development, crop production, fisheries, and recreation. Now more than ever it is necessary to develop new ways to meet the demands of climate change and an increasing population.

Our role in dealing with these issues continues to be in both basic discovery research and highly translational applied research that provides information and assistance to our constituents. We use cutting edge technology to develop new processes and solutions and provide this information to our stakeholders. We have strategically prioritized hiring and strengthening research programs in the areas of plant biotechnology and genomics and are leading the nation in several efforts to apply these areas of expertise to issues like cropping systems research and cultivar development for specialty markets as well as genomics database technologies that are the world standards. Our biological systems engineers are working on precision systems for delivering water and fertilizer at appropriate times for efficient crop yield and resource management and on remote monitoring to close the loop and measure local effects on a large scale. Our integrated pest management programs are developing genomics as well as management techniques to minimize traditional chemical pesticide use while effectively managing pests across a broad variety of agricultural crops and urban environments. And our energy extension programs are pioneers in areas like building technology and plant operations efficiency.

WSU researchers have garnered millions of dollars in extramural support to leverage their capacity grant funds into discovery and development research important to the citizens of Washington State. In 2016, 2017 and 2018, WSU was the top university in the nation for total dollars awarded from USDA National Institute of Food and Agriculture in total research and development dollars and over 80% of that total was from ARC and Extension faculty. The Northwest Advanced Renewables Alliance supported transformational research to make a sustainable aviation biofuels industry a reality which remains a strong initiative following the successful completion of that grant. The largest gift to Washington State University overall is still from the Washington Tree Fruit Commission, which approved check-off increases worth an estimated \$32 million over the eight years of the increased assessment for support of apple, cherry and pear research and extension. Other support in endowed professorships and research funding has been made available from organizations like the Washington Grain Commission (which has endowed several professorships at WSU and notably also donated over \$5 million dollars to build a grains greenhouse), the Washington Potato Commission, the Washington Hops Commission and the Washington Wine Commission (which donated funding for the Ste. Michelle Wine Estates WSU Wine Science Center). There is a very vibrant relationship between WSU Research and Extension and numerous commodity-based entities in the state and region and we view this as a validation of the value placed on our efforts by our constituents and stakeholders. Our county partners contribute more than \$10 million annually - in cash and kind - to support county Extension operations and over \$6 million annually in research funding.

There are numerous societal, environmental and scientific challenges that can be addressed by cutting-edge research and through the application of that research to the practical issues that face the residents of Washington. Every year we assess and evaluate our research portfolio to strategically prioritize our efforts to ensure the greatest impact is derived from both our research and extension programs. As a result, we can continue to deliver important outcomes including economic benefits to agricultural and natural resource-based industries, government entities, communities, and individuals. Additionally, our research and outreach help ensure that the people of Washington State maintain a high quality of life by limiting the negative impacts of chronic disease, food insecurity, and obesity. Finally, our programs help ensure that the beauty of the state and its natural resources are sustained for future generations. This annual report endeavors to summarize the inputs, outputs, and impacts of our work conducted during the year.

2. FTE Estimates

Year	1862 Extension	1862 Research
2020	277.0	338.6
2021	279.0	341.0
2022	279.0	341.0
2023	279.0	341.0
2024	279.0	341.0

II. Merit / Peer Review Process

Merit evaluation takes place at several levels. Prioritization for specific programs is manifested by allocations of effort and limited funds. In 2017 we implemented a new strategic prioritization of our Hatch capacity funds in order to better align with stakeholder needs and researcher capacity. We organized our research projects into fourteen main collaborative topic areas that were based on organic associations and are reflective of college strengths. Review and evaluation of research projects occurs prior to project submission and on an annual basis through REEport.

Individual WSU faculty program plans are developed through statewide planning processes informed by the NIFA Plan of Work, the College of Agricultural, Human and Natural Resource Sciences Strategic Plan, and the WSU Strategic Plan. Faculty members are reviewed annually on a set of performance expectations that include: effective program planning, implementation, and evaluation of impact; scholarly work and creative outreach materials; success with grants and extramural funding; leadership and teamwork; professional development; and service to the public and the institution. Annual merit ratings are assigned based on accomplishment within these categories, which are also the performance expectations considered for tenure and promotion of Extension Faculty. All faculty report at the end of the calendar year into our electronic Activity Insight database which can be accessed quickly at any time during the year that the information is needed. The progress of faculty work is reviewed by Program Directors, Department Chairs, Associate Deans and the Dean as an integral part of the annual performance review process. WSU faculty receive over 60% of their total funding from extramural sources, including USDA grants, grants from other agencies, foundation grants, and commodity commission grants. These funding agencies subject our proposals to expert peer review by scientific panels and by industry professionals and growers. All WSU Extension publications undergo a double-blind peer review. Reviewers include faculty at WSU or other Grant Universities, state and federal agencies, or research faculty at non-Land Grant universities.

III. Stakeholder Input

1. Actions to Seek

Stakeholder involvement is sought through a variety of means.

Relationship building through advisory councils, boards, regular meetings with key partners state-wide
Workshops

Presentations at Commodity Commission Board and other state agency board meetings

Host Field Days statewide

Engagement with Master Gardeners, Master Beekeepers, 4-H

Electronic media (email, listservs, websites, social media platforms, newsletters)

Radio

Direct mail

Telephone contacts

Personal visits

Articles and stories in local, state, and regional periodicals, newspapers, magazines

Electronic surveys (using Qualtrics, Remark or Survey Monkey, and Turning Point software and clicker technology at workshops)

2. Methods to Identify

Annual assessments of general population characteristics, agricultural trends, natural resource-related issues, human health trends, and business dynamics are carried out as needed and are largely based on analysis of data collected by agencies external to the University, such as the US Census Bureau, National Agriculture Statistics Service, Washington Department of Natural Resources, Washington Department of Health, Washington Department of Agriculture, and the Washington Department of Commerce. To meet specific needs, these are supplemented in some cases by focused internal or stakeholder commissioned studies. These data help WSU faculty and staff and the commissioning stakeholders identify target audiences and define specific needs. We then develop appropriate research and outreach to address these needs.

3. Methods to Collect

The ARC and WSU Extension use local and statewide advisory committees to provide input to the leadership, the faculty, and staff of Washington State University. These include the College of Agricultural, Human and Natural Resource Sciences (CAHNRS) Advisory Council, the Center for Sustaining Agriculture and Natural Resources Advisory Committee, advisory committees at each of the four Research and Extension Centers, and county, departmental, and program-specific advisory committees.

When appropriate, feedback is sought through designed focus groups and designed surveys. This form of feedback is critical for evaluating new approaches, technology applications, and new outreach methods. Additionally, technical surveys are often designed by either an Evaluation Specialist or the Division of Governmental Studies and Services to assess public attitudes, most recently in partnership with the Washington Association of Sheriffs and Police Chiefs. Needs assessment is an expectation of all WSU Extension faculty members. These processes are deeply engrained in our program development processes. Alternative mechanisms have been developed to garner input from non-English speaking communities, refugee communities, and from other underserved populations. In these cases, WSU Extension often employs individuals from these communities who understand the cultures and traditions. This improves communication and assessment of need.

The ARC and some parts of Extension work closely with the 22 agricultural commodity commissions in the state to clearly understand the needs of their clientele. Joint work with these commissions often involves collaborative project design and follow-up presentation of results. In addition, the leadership of CAHNRS and WSU Extension sit on several statewide boards and numerous statewide committees and councils. These venues provide opportunities for soliciting and receiving input from numerous segments of society including tribes, state and federal agencies, the private sector, and the general public. Input is generally solicited in processes involving application of resources, including developing priorities for research and outreach, project design, and program delivery.

4. How Considered

Input from stakeholders strengthens our ability to assess need and demand, and to identify potential partners, identify emerging issues, and to evaluate the effectiveness of our research and extension programs in addressing these issues and needs as we move forward with Research and Extension activities, initiatives and programs. Our programs are directly influenced by stakeholder feedback and input.

The highest priority for our stakeholders is to support innovative research and extension outreach that addresses important issues that are critical to profitability, sustainability, and their health and well-being. Many stakeholders prioritize natural resources concerns related to water quality, water quantity, forest health, rangeland health, and stewardship. Local food systems and the desire for community connections with our food supply was another recurring theme, as was the desire to have us investigate new methods and practices for organic food production. Concerns over human health and diet, along with the growing incidence of obesity in our population were clearly stated as priorities and there was a desire to implement educational outreach to change behaviors. Consumer food safety education, positive youth development, and outreach to sustain rural communities were among several other stakeholder-defined issues that are being addressed by our current work. Emerging issues this year include the opioid crisis, access to affordable healthcare, and trust in government.

IV. Critical Issues

1 Sustainability, Security and Resilience

Description:

The State of Washington is subject to a wider array of environmental, economic, policy and political stressors and challenges than most other states. Because of the complexity and variety of its environment, economy and society. WSU seeks to assist in the effective prevention, response, mitigation and mediation, and recovery from these challenges. WSU research and extension faculty are committed to the sustainability, security, and resilience of our communities, our State, and especially of our agricultural economy that is vital to the well-being of our citizens and for the consumers of our products locally, regionally, and nationally. Basic research that increases the sustainability and security of the food, fiber, and fuel supply in the state of Washington while developing human capacity is of primary importance to our stakeholders and to our citizens. Evidence-based solutions are desperately needed to ensure a readily available, affordable food, fiber and fuel supply in response to such challenges as global climate change and pests and pathogens that continue to evolve and thwart efforts at control and as people move from rural, agriculture areas to urban population centers. This dynamic has only been made more clear by the experiences of the COVID pandemic. Efforts in other sectors include engagement on the quality of governance and on public policy issues, as well as in the arenas of public safety and disaster resilience.

Term: Long

Science Emphasis Areas

Agroclimate Science
Bioeconomy, Bioenergy, and Bioproducts
Education and Multicultural Alliances
Environmental Systems
Family & Consumer Sciences
Food Safety
Human Nutrition
Sustainable Agricultural Production Systems

2 Community and Economic Development**Description:**

Communities, whether incorporated cities/towns, unincorporated villages, or communities of affinity, are essential to the well-being of individuals and the strength and success of society. Many -- if not all -- of the activities conducted by a land-grant institution such as WSU impact the development, strength and success of communities. WSU addresses community development, economic development and resilience both directly and indirectly through these efforts. Direct engagement will focus through the Extension Community and Economic Development program, informed by the Community Capitals Framework (Emery & Flora, 2006). New external partners such as the Association of Washington Business (Institute) will support expansion of resilience efforts as a whole, as well as individual components like workforce development.

Term: Long

Science Emphasis Areas

Bioeconomy, Bioenergy, and Bioproducts
Education and Multicultural Alliances
Environmental Systems
Family & Consumer Sciences

3 Natural Resources**Description:**

WSU scientists, educators and specialists will conduct research and extension programs leading to a better understanding of the interaction between human development and terrestrial, aquatic, and atmospheric conditions, investigate carbon sequestration innovations and technologies and improve soil health, manage and mitigate urban storm water runoff, restore riparian areas, provide wood and fuel using sustainable production

practices, develop innovative mechanisms for revegetating mining sites, watersheds, and native prairies, and understand habitat requirements of key and endemic species. Extension educators will work with researchers and local communities to develop customized, science-based solutions to local problems and to enhance understanding in target audiences about new tools to more effectively manage and sustain natural resources. In 2021 the Washington Legislature prioritized Forest Health. Extension and Research faculty and staff will substantially contribute to the success of this initiative through efforts on forest management, wildfire prevention & mitigation, community preparedness, and enhanced response and recovery.

Term: Long

Science Emphasis Areas

Agroclimate Science
Bioeconomy, Bioenergy, and Bioproducts
Education and Multicultural Alliances
Environmental Systems
Family & Consumer Sciences

4 4-H Youth Development

Description:

Youth are a critical component of our society: as the embodiment of our futures, as a gateway to stronger engagement with the adults in their lives, and as the locus for conducting the most effective proactive engagement strategies. With the new national emphasis on categorizing all youth-based activities as 4-H engagement, 4-H takes on even more importance. As a recognition of this importance, 4-H now reports directly to the Associate Dean and Director of Extension. In order to address these multiple challenges and opportunities, research-based programs will be delivered by extension professionals and supervised volunteers. These programs include 4-H club programs, and school and after school youth and family-based programs, such as Strengthening Families, that focus on enhancing preventive mechanisms. Washington State University Extension's 4-H Youth Development programs create opportunities and deliver educational programs that advance life skills for young people, families and their communities. Educational efforts build not only the capabilities of youth but also build the skills of the adult volunteers who mentor them.

Term: Long

Science Emphasis Areas

Education and Multicultural Alliances
Family & Consumer Sciences
Food Safety
Human Nutrition
Youth Development

5 Fostering a Culture of Health

Description:

WSU's new Elson S. Floyd College of Medicine was founded on a philosophy of "distributed medical education" to address underserved - primarily rural - communities. In coordination with the medical school, WSU Extension and ARC will seek to coalesce existing and new initiatives and activities to support a full-spectrum culture of health across Washington. This includes food and nutrition as essential element components of health, as well as education, training, and engagement on prevention. It will also include intervention in critical health issues such as opioid misuse. Extension programs such as EFNEP and SNAP-Ed will be important elements of this effort, as well as prevention science, clinical intervention, and recovery support. Our experience within the context of the COVID-19 pandemic reinforced the pressing need for these services and necessitated the development of new platforms and approaches which will inform our future operations.

Term: Long

Science Emphasis Areas

Education and Multicultural Alliances

Family & Consumer Sciences

Food Safety

Human Nutrition